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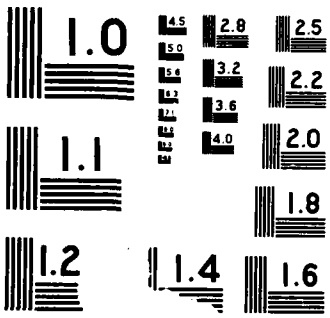
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19. ABSTRACT (Continue on reverse if necessary and identify by block number)

The transfer of the researcher from Florida State University accounts for the short duration of this grant. During the six months this grant, the investigator made progress extending the theory of free boundary control (or singular control) to the multidimensional case. Two papers were submitted for publication: 'Optimal correctons poblem of a multidimensional stochastic system' and 'Deterministic equivalents for a continuous linear-convex stochastic control problem.'

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Final report in the research on

FREE BOUNDARY CONTROL OF THE MARKOV PROCESS

conducted under the auspices of the

Air Force Office of Scientific Research
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During a brief period of time from July 15, 1987 until November 1987, significant progress was made. The most important part of it was the extension of the theory of the free boundary (or singular in other terminology) control to the multidimensional case (see Menaldi and Taksar [1987]). It was shown that there exists an optimal region which the stochastic system under control should be confined to and angles of reflection at the boundary of this region corresponding to the direction of the optimal push when the system reaches the boundary. In terms of automatic cruise control of an aircraft it means that the correction mode should not be initiated unless the plane reaches a certain boundary around the prescribed course and the angle of reflection shows the direction in which the aircraft should be steered while reaching that boundary.

Another work has been done in finding a deterministic equivalent for certain kinds of stochastic control problems (see Sethi and Taksar [1987a]). It was shown that for the problems with linear control cost and convex holding cost functions, there exist equivalent deterministic problems which yield the optimal trajectories by much simpler methods. The optimal policies in the

stochastic models is to keep the systems as close to the optimal deterministic trajectories as possible.

There are several papers which are now under preparation or completion. One deals with applications of stochastic control techniques to financial models (Sethi and Taksar [1987b]). The other paper studies the theory of probability metrics, which can be used for the optimal selection and matching problems (such as matching army recruits to the jobs needed to be performed, cf. Rachev and Taksar [1987]).

Paolo Santana was supported in his graduate studies by the grant. He has successfully completed his research on the problems associated with singular control on a finite time interval. He is now completing the writing of his thesis "Finite Horizon Singular Control and a Related Two-Person Game". The defense of his thesis is expected to take place in January-February of 1988. In his work he has rigorously proved the link between the optimal singular control on a finite time interval and an optimal stopping game of two persons with opposite interests. An article on the subject of his thesis is now being written.

The results of the work conducted under the auspices of the AFORS Grant 87-0278 were presented at the Xth Triennial World Congress of the International Federation of Automatic Control in Munich, Germany, 1987, also at the ORSA-TIMS meeting in St. Louis, Missouri, October 1987, and will be presented at the 26 IEEE Conference on Decision and Control, in Los Angeles, December 1987.

Below is the list of work done under the auspices of the grant:

Menaldi, T.I., and Taksar, M.I., (1987), Optimal Correction Problem of a Multidimensional Stochastic System", submitted to Automatica.

A multidimensional stochastic linear system with additive input and linear cost of control is investigated. The optimality equations are solved and existence of optimal policy is proved.

Sethi, S. and Taksar, M.I. (1987a), "Deterministic Equivalents for a Continuous Linear-Convex Stochastic Control Problem", submitted to SIAM Journal on Control and Optimization.

A one-dimensional stochastic system with convex holding and linear control cost is investigated. It is shown that there exists an equivalent deterministic system whose optimal cost is the same. The optimal deterministic trajectory is also optimal in a certain sense for the stochastic system as well. However, there does not exist an optimal policy which yields this trajectory.

Sethi, S. and Taksar, M. I., (1987b), "Infinite Horizon Investment/Consumption Model with a Nonterminal Bankruptcy" submitted to Journal of Economic Theory.

A sticky Brownian motion is used to model bankruptcy behavior in the optimization investment/consumption model. An agent faces the problem of maximizing his total expected discounted utility of consumption, while simultaneously maintaining the portfolio of risky and risk-free assets. If he goes bankrupt, then he stays at the bankruptcy state for the period of time which is in inverse proportion to his recovery rate $\mu$. A correspondence between this model and a model with terminal bankruptcy is established an an optimal policy is found.

Menaldi, J. L., Santana, P., Taksar, M.I. [1987], "Finite Horizon Singular Control and a Related Two-Person Game" (in preparation).

The singular control problem with both running and terminal cost is solved for a finite time-interval. The variational inequalities pertinent to the optimality equations are solved by reducing the problem to the optimal stopping game of two players with opposite interests.

Rachev, S. and Taksar, M. I., 1987, "Kantorovich Functionals in Space of Probability Measures and Their Applications" (in preparation).

The classical problem of Monge consists of optimal transportation of a mass from one place to another by splitting it into infinitesimally small particles and then associating them with their new positions so that the sum of products of the paths of the particles to the corresponding volumes is the least. In 1942, Kantorovich gave the probabilistic version of this problem known now as Monge-Kantorovich transportation problem. We consider the relationships between various types of transportation problems, dual and explicite solutions of such problems and their applications to the classification problems of assigning of army recruits to different jobs and to the problems of best allocation policies in medical treatments.

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